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ABSTRACT

The issue of rates of return to educational investment over time is discussed, noting that the examination of this subject enjoyed its heyday in the middle and late 1970s. A longitudinal examination of internal rates of returns to college education for different time periods is included. Some of the reasons for reexamining the issue are: the decline in rates of return was due in part to a large growth of the college-educated cohort size in the early 1970s, the business cycle may also affect the rate of return, and since 1974, the business cycle has gone through a complete cycle (from regression to peak to recession and to more expansion); and if educational expenditures are considered as investment, then the yield should behave similarly to more conventional investment. The model used in the study is a two-stage simultaneous equation system which corrects for self-selectivity bias. Samples for the various years are drawn from the Panel Study of Income Dynamics conducted by the Survey Research Center of the University of Michigan. Results include the following: the declining rates of return over the first three time periods are consistent with the notion that as schooling expands, the social rate of return should fall; the rates of return to education should follow the same general pattern as investment in other types of assets; and the rate of return to educational investments has policy implications. Tables are included. Contains 19 references. (SM)

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SOCIAL INTERNAL RATES OF RETURN TO COLLEGE EDUCATION IN THE UNITED STATES: 1969, 1974, 1978 AND 1982

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I. INTRODUCTION

Examination of the rates of return to educational investment over time enjoyed its heyday in the middle and late 1970's. In particular, Richard Freeman (1975) touched off a heated debate with the assertion that the return to college education fell dramatically during the early part of the 1970's. Freeman claimed that the social and private internal rates of return fell from 11 and 12 percent, respectively, in 1968, to 7.5 and 8.5 percent, respectively, in 1973. Freeman stated that the rate of return in 1973 was a "losing proposition" because the returns to alternative investments were above those offered by education. To account for the declining rates, Freeman cited a decrease in the demand for college graduates which resulted from changes in the industrial structure of the nation. Also, the supply of collge graduates continued to rise as a result of a massive expansion in public higher education during the 1960's and early 1970's.

Several challenges were made to Freeman's work (Schwartz and Thornton, 1980; Witmer, 1980; Rumberger, 1980). In each case, Freeman defended his findings. (See, for example, Freeman, 1980.) Since 1980, very little has been written on

this issue.[1]

The purpose of this paper is to re-examine the issue. There are several reasons for reopening this topic. First, Freeman suggested that the decline in rates of return was due in part to a large growth of the college-educated cohort size in the early 1970's. Since that time, the growth of the cohort groups has slowed. Second, the business cycle may also affect the rate of return, and since 1974 the business cycle has gone through a complete cycle, from recession to peak to recession and to another expansionary phase. If cohort size and business cycles affect earnings and rates of return to education, the need to investigate the returns to education in recent years is fairly obvious.

Psacharopoulos (forthcoming) has laso noted several reasons for discussing rates of return over time. First, if educational expenditures are considered as investment, then the yield should behave similar to more conventional investment. Thus, as educational attainment expands, rates of return should fall, other things equal. Second, alternative theories of the labor market can be partially tested by examining the behavior of rates of return to education. One example Psacharopoulos offers is that

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[1] One notable exception is McMahon and Wagner (1982). See Cohn and Geske (1986) and Leslie and Brinkman (1988) for surveys on the rates of return to college education.

declining social rates of return would be inconsistent with the screening hypothesis, since those with greater amounts of education would be unable to maintain their earnings advantage over the less educated. A third reason given for studying rates of return relates to the equalizing effect of educational expansion on the distribution of income. Declining rates of return would, *ceteris paribus*, be consistent with increased equalization.

Moreover, this study provides a longitudinal examination of internal rates of returns (IROR) to college education for the period that Freeman investigated and also for more recent years. This is, furthermore, accomplished by using a data set that is specifically designed for longitudinal analyses. Finally, our methodology is relatively more rigorous compared to earlier IROR studies.

II. METHODOLOGY

The model used in the study is a 2-stage simultaneous equation system which corrects for self-selectivity bias. Weisbrod (1966) notes the possibility of selection bias in estimating returns to education. Some of the earliest work correcting for selection bias was conducted by Gronau (1974) and Lewis (1974). Further work has expanded this approach to examine various questions in the human capital field. For example, Nakosteen and Zimmer (1980) have used this

approach in the study of migration, and Kenny et al. (1979) have used this method in examining the decision to attend college or begin work after high school.

The first step in the model is the schooling decision. Some individuals choose to attend college while others opt for the labor force. A set of variables is used to estimate the probability of someone in the sample completing college. This probability is unobservable, though we can observe whether or not the individual has completed college. The probability of completing college is given by

$$COLL = f(Z) \qquad (1)$$

where the variables in the vector, Z, are described in Table 1. Since COLL is a binary indicator, ordinary least squares (OLS) estimates are inefficient and the predicted probability may have a value outside the (0,1) interval. As a result, estimation of the first equation is performed using maximum likelihood (ML) techniques.

The second equation in the system follws the standard Mincerian earnings function which in our model is

$$LNHRERN=f(COLL,TENURE,TENURE2,AGE,AGESQ,COVER,NORTHE,WESTE,MARST,SELF,LAMBDA) \qquad (2)$$

where the variables are defined in Table 2.

The two-stage estimation procedure used here was proposed by Heckman (1976). The probit ML estimates generated in the first step are used to construct the inverse of Mill's ratio, represented by LAMBDA in equation 2. The LAMBDA variable is used to make corrections for self-selectivity bias. The second stage, equation 2, includes LAMBDA as a regressor in the OLS estimation of hourly earnings.

The results obtained from the two-stage process are then used to calculate the IROR for those individuals who elect to complete a four-year college degree program relative to those with only a high school diploma. The IROR is defined as the rate of discount which equates the present values of the benefit and cost streams of a project. This rate can be found by solving for r in equation 3.

$$\sum_{t=0}^{n} (b_t - c_t)/(1+r)^t = 0 \qquad (3)$$

where r is the desired IROR, b_t and c_t, respectively, are annual benefits and costs in year t, and n is the economic horizon of the project.

The benefit stream is defined as the lifetime earnings differentials of the college graduate. The present value of the costs is comprised of the foregone earnings of the college graduate and the direct costs of providing a college degree program, though in our analysis foregone earnings are automatically deducted from the benefit stream (following

Hansen, 1963).

III. THE DATA

The samples for the various years are drawn from the Panel Study of Income Dynamics (PSID) conducted by the Survey Research Center of the University of Michigan. Included in the sample are those individuals who were heads of households during the interview years of 1970, 1975, 1979, and 1983. In addition, members of the sample worked at least 1000 hours during the preceeding year, but not more than 2500 hours. This approach limits the sample to those who would be considered employed on a full-time basis. Descriptive statistics of the four samples are provided in Appendix Table A.

Cross-sectional data are used to determine whether or not the economic status of college graduates has changed through time. The years selecteed for the study are at various points in the business cycle in an attempt to identify any trends which the cross-sectional data may mask. The year 1969 marked the end of a decade-long growth period; 1978 was another period when unemployment had been falling and the economy beginning to expand. The two years 1974 and 1982 represent years characterized by higher rates of unemployment and general recessionary tendencies.

Limitations in the data required us to examine only the earnings of white males. The number of females of both races with college degrees who were also heads of households in the early years of the study was too small to be statistically valid. This same problem arose for black males in two cases.

The data set for the earnings equations for all four years includes most of the variables typically used in age-earnings profiles. One potential problem with our approach is the possible correlation of AGE and TENURE. However, the correlation coefficient was found to be less than 0.05 in all four years, and thus both variables are included in the earnings regression. Direct costs were estimated from the *Digest of Educational Statistics* and are shown in Table 3. Since we are concerned with *social* IROR's, the *total* costs to education should be considered, but since certain items in the institutional cost data (such as public service, auxiliary enterprises, and hospitals) might not represent purely educational endeavors, these cost items are not included. Total direct costs were divided by full-time equivalent enrollments to obtain per-pupil direct costs.

IV. RESULTS

Table 4 shows the results of the ML estimates for college

completers.[2] Generally, the results for the college equation are consistent with a priori expectation. The variables FED, FSES, and MED (for 1978 and 1982) exhibit the expected positive sign (except for FED in the 1974 equation.) SIBS is found to have, as expected, a negative effect on the probability of college completion.

Several unexpected results may be noted. First,the sign on the WAR coefficient changes from negative in 1969 to positive for the remaining three years. Second, the coefficients of ADJERN (adjusted earnings at age 17) are highly significant and negative in 1978 and 1982, but have a positive sign for 1974. Further, ADJERN is not significant in the 1969 equation. Third, the variable SMALL changes from positive and significant at the 1 percent level in 1969 to negative and significant at the 5 percent level in 1974; thereafter, it is not significant.

Table 5 displays the results from the OLS estimation of the earnings equations for college completers.[3] AGE and AGESQ have a significant effect on the log of hourly

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[2] For the years 1969 and 1974, the variables MED and CATH were not available. Also, the variable UNION was used in those years in lieu of COVER.

[3] These equations are OLS estimations using the results from the ML probit equations of Table 4. For the 1974 sample, none of the college graduates were self-employed or lived in the western region of the nation. As a result, these variables had to be excluded from the regression equation for 1974.

earnings; AGE affects earnings in a positive manner while AGESQ has a negative effect. These results are as expected. Marital status has a positive and significant effect only in 1978 and 1982. TENURE and TENURE2 exhibit their expected signs in all cases, though TENURE2 is not significant in 1978. In 1969, UNION is found to affect earnings in a negative fashion, the only instance where this variable is significant. The negative sign might be explained by positing that college-educated respondents who are union members accepted employment in the blue-collar sector of the economy while their nonunion counterparts were in managerial or professional occupations, traditionally nonunion fields. Since, on average, blue-collar workers receive lower pay than managers and professionals, the negative union effect should not be surprising.[4]

One other point should be noted. The self-selectivity correction factor, LAMBDA, is shown to be not significant in three of the four years. This finding implies that self selection is not a major problem. However, for 1974, LAMBDA is significant at the 1 percent level. The negative sign on the coefficient indicates a positive selection bias. Those individuals who chose college have higher incomes than would

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[4] In our other specifications for college graduates, union membership and union coverage were consistently not significant, while for workers with a high school diploma, membership or coverage consistently demonstrated a positive effect on earnings.

be predicted for the entire population had everyone chosen to end their formal education at the college level, *ceteris paribus*.

The magnitude of this positive bias can be computed by multiplying the coefficient of LAMBDA by the mean value of LAMBDA. In this case, the estimated earnings of white male college graduates are 38.4 percent higher than they would have been had everyone in the population (i.e. all white males) finished college.

To compute IROR's, age-earnings profiles were generated from the regressions in Table 5, setting each of the independent variables (except for AGE and TENURE) equal to the mean for the respective college samples. The variable TENURE was found by taking the average length of time on the current job of respondents for each age, from 18 to 65. From these lifetime earnings profiles, we then subtracted the respective predicted lifetime earnings for individuals who completed only a high school education but who have characteristics similar to the average characteristics of the college-graduate samples. This process generated four lifetime-earnings-differentials profiles attributable to college education (one for each of the sample years), providing the b_t's for equation 3.

Three alternative estimates of costs (c_t in equation 3) are provided: Total, public and private. Assuming that the

b_t's are invariant with respect to the type of college selected (i.e., private vs. public), calculation of the IROR to completers of public colleges should include b_t and the c_t associated with the costs of public colleges. Conversely, for completers of private colleges, the relevant c_t should correspond to the costs of attending private colleges. Since the costs of private colleges are considerably higher than those of public colleges, the IROR to public education would exceed the IROR to private education. It must be emphasized, however, that our results are highly tentative, since it is intuitively plausible that (on average) the b_t's for private education exceed those of public education (if that were not the case, the implication would be that millions of students attending private schools are making very poor investment choices). Because of data limitations, we cannot generate separate b_t's for private and public college graduates.

The internal rates of return are shown in Table 6. As may be observed from the table, the IRORs declined from 1969 to 1974, and again from 1974 to 1978. We find, however, an increase in the IRORs from 1978 to 1982. This pattern is observed for each of the direct cost estimates (total, public, and private). It is expected that IRORs in recent months might be even higher. A recent New York Times News Service report suggests that, in real terms, the median income of high school graduates decreased by 24 percent from

1972 to 1985, compared to a 7 percent decrease for college graduates, which is cited as one of the reasons for the recent surge in college applications (Carmody, 1988).

For all universities, the IRORs fell from a high of 9.26 percent in 1969 to a low of 6.09 per cent in 1978 and rebounded slightly in 1982 to 6.87 percent. As would be expected, the rates of return to publicly funded institutions, with their lower costs, are higher for each time period. From a high of 9.52 percent in 1969, the rate dropped to 6.21 percent in 1978 and increased to 7.03 percent in 1982. The IRORs to private schools declined from 8.52 percent in 1969 to 5.72 percent in 1978, and then increased to 6.43 percent in 1982.

Our results are consistent, in general, with those of Freeman, showing a decline in the IROR to college education during the 70's. The recent surge in the IRORs indicates, however, that the reduction in IRORs to college education might have been a temporary phenomenon, and that market forces play a role in the college attendance decision.

V. CONCLUSION

The results from the current work lend some support to the results of Psacharopoulos. The declining rates of return over the first three time periods are consistent with

the notion that as schooling expands, other things equal, the social rate of return should fall. As with other investments, as the supply of funds available for investment expands and as the proportion of individuals in the population with a college degree expands, the returns to those investments would fall.

The observation that IRORs have increased by 1982 could be interpreted in one of two ways. First, the increase in returns could imply that business cycles and cohort size are important factors in determining the rates of return to education. 1982 was not a boom year, yet it preceeded a period of steady economic growth in the United States. Also, following as it did the Economic Recovery Act of 1981, the higher rates could signal that businesses were anticipating greater output and sales; they reacted by increasing the wages and salaries of employees.[5]

Second, the rates of return to education should follow the same general pattern as investment in other types of assets. Thus, if 1982 saw an increase in the real rate of return to investment in plant and equipment, then the rate of return to education should also increase.

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[5] Even if employers increase wages proportionately to college educated and high school educated workers, the IROR to college education would rise, because the important variable is the absolute earnings differential.

The rate of return to educational investments has policy implications. If the rates of return fall below the return to alternative types of investments, then it would be difficult to justify additional educational expenditures by the government. By the same token, if rates of return to education exceed those for other investments, governmental assistance to educational funding might be justified.

Several caveats should be mentioned. First, the estimated IRORs are based on a particular data set and restricted samples. Second, although we experimented with different functional forms for the ML and OLS models and found our present model to be quite robust, it is possible that alternative estimation models could produce different results. Third, the calculation of IRORs does not distinguish between those attending college part time while working full time, and those who attend college full time and do not work or only work part time. Recent findings (Cohn, 1983) suggest that the foregone earnings of part-time students are nil, and hence their IROR might be considerably higher than indicated here, provided that their b_t's are unaffected by the part-time attendance status.[6] All in all, however, we believe that our results are quite reasonable, providing a foundation for further discussion on such

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[6] This supposition has some empirical support. See, e.g. Kiker and Wilder (1975).

important issues as overeducation and government's role in subsidizing higher education.

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TABLE 1

LIST OF VARIABLES IN SCHOOLING EQUATION

COLL	Indicates whether or not the individual has a college degree. = 1 if yes; = 0 otherwise.
FED	Number of years of schooling of father.
FSES	Socioeconomic status based on father's occupation. Duncan scale was used.
MED	Number of years of schooling of mother.
SIBS	Number of brothers and sisters in the family.
NORTH	Indicates whether or not the individual grew up in the North. = 1 if yes; = 0 otherwise.
WEST	Indicates whether or not the individual grew up in the West. = 1 if yes; = 0 otherwise.
LARGE	Indicates whether or not the individual grew up in a large city. = 1 if yes; = 0 otherwise.
SMALL	Indicates whether or not the individual grew up in a small town or urban area. = 1 if yes; = 0 otherwise.
WAR	Indicates whether or not the individual was 17 years of age when a war was in progress. The war years are 1942 through 1945, 1950 through 1953, and 1965 through 1972. = 1 if yes; = 0 otherwise.
ECSITER	Indicates the family income status while the individual was growing up. = 1 if average or above average income; = 0 if poor.
UNEMP	The unemployment rate during the year when the individual became 17 years of age.
ADJERN	The national average of earnings, adjusted for inflation, in the year when the individual became 17 years of age.

TABLE 2

LIST OF VARIABLES IN EARNINGS EQUATION

LNHRERN	The natural log of the hourly earnings of the respondent.
AGE	Age of the respondent.
AGESQ	AGE squared.
TENURE	The number of months the respondent has been on his current job.
TENURE2	TENURE squared.
MARST	Marital status of respondent. = 1 if married; = 0 if unmarried.
SELF	Indicates whether or not the individual is self-employed. = 1 if self-employed; = 0 if otherwise.
COVER	Indicates whether or not the respondent is covered by a collective bargaining agreement. = 1 if covered; = 0 if not covered.
UNION	Indicates whether or not the respondent is a union member. = 1 if union member; = 0 if otherwise. (This variable was used in place of COVER for the year 1969.)
NORTHE	Indicates whether or not the respondent resides in the Northern states. = 1 if yes; = 0 otherwise.
WESTE	Indicates whether or not the respondent resides in the Western states. = 1 if yes; = 0 otherwise.

TABLE 3

ANNUAL DIRECT COSTS OF COLLEGE PER STUDENT

Year	All Schools	Public	Private
1969	3110	2829	3967
1974	4674	4251	5961
1978	4579	4165	5840
1982	5445	4885	7150

SOURCE: Digest of Education Statistics, various years.
The costs were computed by subtracting expenditures for public service, auxiliary enterprises, hospitals and independent operations from the current-fund expenditures per full-time equivalent student in institutions of higher education.

TABLE 4

Maximum Likelihood Estimates for College Completers
(Asymptotic t statistics in parthenteses)
(Dependent variable is COLL)

Independent Variable	YEAR			
	1969	1974	1978	1982
INTERCEPT	-1.928 (-7.164)	-3.700 (-7.445)	-0.468 (-2.083)	-0.455 (-1.865)
FED	0.002 (8.102)	-0.020 (-0.291)	0.063 (5.609)	0.072 (5.901)
FSES	0.002 (0.969)	0.020 (5.926)	0.006 (3.326)	0.007 (3.786)
MED	-----	-----	0.046 (3.938)	0.068 (5.053)
SIBS	-0.122 (-7.433)	-0.047 (-1.764)	-0.115 (-7.425)	-0.109 (-6.503)
NORTH	-0.751 (-0.930)	-0.090 (-0.689)	-0.076 (-1.015)	-0.180 (-2.405)
WEST	0.419 (3.596)	0.060 (0.320)	-0.185 (-1.714)	-0.002 (-0.020)
WAR	0.483 (5.202)	-0.432 (-3.218)	-0.173 (-2.305)	-0.266 (-3.565)
ECSITER	0.066 (0.921)	-0.040 (-0.306)	0.091 (1.189)	0.079 (0.981)
UNEMP	0.033 (4.258)	0.016 (0.835)	-0.015 (-1.648)	-0.024 (-1.850)
ADJERN	-0.032 (-0.321)	0.822 (4.873)	-0.453 (-5.764)	-0.535 (-6.435)
LARGE	0.361 (3.746)	0.384 (2.632)	0.269 (3.354)	0.333 (3.933)
SMALL	0.307 (3.555)	-0.294 (-2.006)	-0.026 (-0.341)	-0.060 (-0.731)
CATH	-----	------	-0.416 (-0.988)	0.078 (0.567)
Chi-Squared	324.73	113.65	326.76	402.34
N	2266	1336	2358	2207

TABLE 5

Ordinary Least Squares Estimation for
Earnings Function of College Completers
(t statistics in parentheses)
(Dependent variable is LNHRERN)

Independent Variable	1969	1974	1978	1982
INTERCEPT	0.105	3.812	-0.216	0.106
	(0.356)	(6.764)	(-0.784)	(0.367)
AGE	0.066	0.156	0.112	0.110
	(4.421)	(4.540)	(7.590)	(7.543)
AGESQ	-0.001	-0.002	-0.001	-0.001
	(-3.651)	(-4.148)	(-6.763)	(-6.642)
MARST	-0.001	0.025	0.094	0.140
	(-0.005)	(0.342)	(1.649)	(1.930)
SELF	-0.034	----	-0.108	-0.063
	(-0.096)		(-1.863)	(-1.031)
TENURE	0.051	0.120	0.023	0.022
	(4.830)	(2.175)	(3.223)	(2.441)
TENURE2	-0.002	-0.008	-0.001	-0.001
	(-4.294)	(-2.109)	(-1.093)	(-2.015)
UNION	-0.404	-0.025	----	----
	(-5.908)	(-0.457)		
COVER	----	----	-0.001	-0.043
			(-0.022)	(-0.685)
NORTHE	0.197	0.066	0.016	-0.007
	(4.736)	(1.174)	(0.423)	(-0.166)
WESTE	0.124	----	-0.045	0.038
	(2.270)		(-0.776)	(0.604)
LAMBDA	-0.023	-0.245	-0.004	-0.074
	(-0.593)	(-4.466)	(-0.101)	(-1.574)
R^2	.27125	.51583	.27280	.19383
F	17.05	14.78	22.51	14.15
N	469	120	611	612

TABLE 6

INTERNAL RATES OF RETURN TO COLLEGE EDUCATION

YEAR	ALL SCHOOLS	PUBLIC	PRIVATE
1969	9.26	9.52	8.52
1974	8.13	8.35	7.50
1978	6.09	6.21	5.72
1982	6.87	7.03	6.43

APPENDIX TABLE A
Means ($\bar{x}$) and Standard Deviations (s) of Variables

VARIABLE	1969		1974		1978		1982	
	$\bar{x}$	s	$\bar{x}$	s	$\bar{x}$	s	$\bar{x}$	s
ADJERN	1.968	0.455	2.394	0.515	2.479	0.484	2.629	0.430
AGE	38.377	9.951	34.334	11.663	35.469	11.105	35.641	10.461
AGESQ	1571.805	785.590	1324.735	875.890	1381.321	866.774	1379.641	832.575
CATH	----	----	----	----	0.005	0.071	0.054	0.226
COLL	0.207	0.405	0.090	0.286	0.259	0.438	0.277	0.448
COVER	----	----	----	----	0.318	0.466	0.265	0.441
ECSITER	0.601	0.490	0.665	0.472	0.731	0.443	0.753	0.431
FED	8.519	3.010	8.554	3.097	9.627	3,411	10.047	3.451
FSES	27.793	17.913	25.998	15.698	31.034	18.673	32.359	19.651
LARGE	0.243	0.429	0.249	0.432	0.293	0.455	0.304	0.460
LNHRERN	1.481	0.447	1.659	0.301	2.046	0.466	2.381	0.505
MARST	0.969	0.174	0.966	0.182	0.921	0.270	0.943	0.231
MED	----	----	----	----	10.619	3.033	10.904	2.874
NORTH	0.654	0.476	0.641	0.480	0.642	0.479	0.641	0.480
NORTHE	0.608	0.488	0.588	0.492	0.582	0.493	0.575	0.494
SELF	0.043	0.202	0.012	0.109	0.087	0.283	0.102	0.303
SIBS	3.362	2.273	3.451	2.216	3.174	2.182	3.144	2.063
SMALL	0.464	0.499	0.447	0.497	0.411	0.492	0.439	0.496
TENURE	9.152	6.983	9.640	8.275	6.535	7.508	5.154	5.898
TENURE2	132.505	146.639	161.318	161.588	99.051	211.935	61.332	144.215
UNEMP	7.196	5.879	5.946	4.412	5.498	3.485	5.382	2.511
UNION	0.321	0.467	0.487	0.500	----	----	----	----
WAR	0.223	0.417	0.267	0.443	0.252	0.434	0.264	0.441
WEST	0.095	0.293	0.115	0.319	0.126	0.332	0.095	0.293
WESTE	0.142	0.349	0.152	0.359	0.144	0.351	0.131	0.337